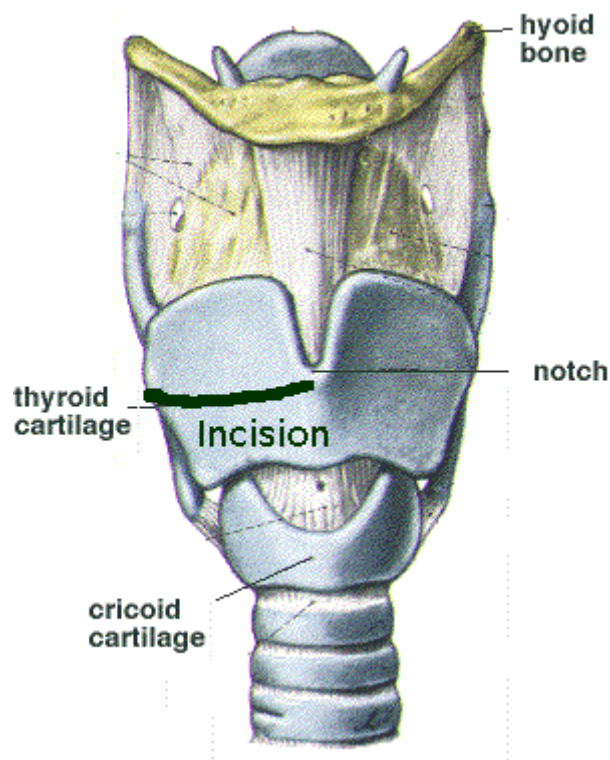


Open approach Conservative Laryngectomy an overview

By

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Introduction:

Organ preservation is becoming common these days. This applies to larynx also. Laryngeal malignancies if identified early can be effectively managed by conservative resection procedures of larynx.

Advantages of organ preservation:

1. The patient need not live with the stigma of permanent tracheostomy
2. Speech is preserved to the maximum extent
3. There is effective separation of air and food channels
4. Post operative recovery is very fast
5. Option of salvage total laryngectomy is still an option if the conservative procedure fails

History:

The first Hemilaryngectomy procedure was performed by Billroth in 1874. The origin of conservative laryngeal surgery for malignancy is nearly a century old. Initially only vertical hemilaryngectomy and supraglottic laryngectomy were commonly performed only to be abandoned due to various problems like tumor recurrence, inadequate tumor margins and other complications due to inadequate tissue repair techniques. With the advent of excellent antibiotics and modern surgical equipments like laser has created a renewed interest in conservative laryngectomy procedures.

Vertical partial laryngectomy was refined in the US by Som.

A French surgeon Huet described a procedure in which a portion

of the supraglottis was excised without the upper portion of thyroid cartilage in 1938. Later the Uruguayan surgeon Alonso extended this procedure to resect the upper portion of thyroid cartilage along with the supraglottis thus modifying supraglottic partial laryngectomy.

Supracricoid laryngectomy was first described by Australian surgeons Major and Reider in 1959.

Principles of organ preservation surgeries involving larynx:

1. Adequate local control of the malignant lesion should be ensured
2. Accurate assessment of three dimensional extent of the tumor
3. The cricoarytenoid unit should be considered as the functional unit of the larynx
4. Adequate cuff of normal tissue should be excised along with the malignant tumor to minimize the chances of local recurrence.
5. The physiological functions of larynx (respiration, speech and swallowing) should be maintained without compromising the loco-regional control of cancer.

Current definition of organ preservation laryngectomy:

It is defined as a combination of surgical procedures that removes a portion of the larynx, while maintaining its physiological functions i.e. (respiration, phonation and swallowing) without compromising the local control of malignancy, its cure rates and obviates the need for a permanent tracheostomy.

Patient evaluation:

This is the most important part in the whole surgical planning.

Evaluation should include:

- a. Detailed history
- b. Dynamic assessment of larynx – This includes indirect laryngoscopic examination, video laryngoscopic examination, stroboscopy. Vocal cord fixation should be distinguished from arytenoid fixation which implies involvement of cricoarytenoid joint (a contraindication for conservative procedures).
- c. Static assessment of larynx – Staging laryngoscopy
- d. Imaging – CT, MRI and PET scans
- e. Head & Neck examination
- f. Exclusion of synchronous lesion in the aerodigestive tract
- g. General medical evaluation including lung function tests, cardiac evaluation, nutritional status, motivation, rehabilitation advice.

Eventhough accurate staging of the tumor is a must for successful conservative laryngectomy the currently available staging system is fraught with a number of pitfalls. They include:

1. The difference in the behavior pattern of severe dysplasia and carcinoma in situ is unclear and is not reflected in the currently available staging sytem.
2. Eventhough anterior commissure involvement is vital in deciding the outcome of any partial surgeries it is not reflected in the existing TNM staging system available
3. Motion impairment of vocal folds is purely subjective with a high degree of observer variation. This could lead to an erroneous staging
4. The size of the lesion and its molecular characterization (overexpression of p53 oncogene) are important determinants of tumor behaviour. These factors are not included in the currently available staging protocol

Types of Conservative laryngectomies:

There are two major classes of conservative laryngectomy procedures. They include:

1. Vertical partial laryngectomy
2. Horizontal partial laryngectomy – Two types i.e. Supraglottic partial laryngectomy and supracricoid partial laryngectomy

Vertical partial laryngectomy:

In this procedure the larynx is entered via a midline vertical thyrotomy incision. One half of the larynx can be removed. There are various modifications of this procedure in order to ensure complete tumor clearance.

Gorden Buck performed a laryngofissure surgery followed by complete excision of the tumor mass for laryngeal cancer in 1851. Solis Cohen in 1869 introduced transcervical vertical partial laryngectomy and was able to achieve long term cure for laryngeal malignancy. The goal of this surgery is resection of a portion of thyroid cartilage with the cancer at the glottic level while preserving the posterior paraglottic space. It is hence very suitable in managing early glottic cancers (T1 & T2 lesions) without the involvement of anterior commissure.

Variants of vertical partial laryngectomy:

A classification system has been proposed for vertical partial laryngectomy based on the extent of resection.

Type I Standard vertical

Type II Fronto lateral

Type III Antero frontal

Type IV Extended (any procedure in which one arytenoid is

removed)

Indications for vertical partial laryngectomy:

1. Large T1 glottic cancer – best results are possible if the lesion is confined to the middle third of the vocal cord
2. Small T2 glottic cancer with minimal supraglottic / subglottic extension
3. Early glottic cancer that is difficult to visualize endoscopically
4. As a salvage procedure in patients with radiotherapy failure of early / intermediate cancer

Contraindications for vertical partial laryngectomy:

1. Involvement of cricoarytenoid joint
2. Involvement of thyroid cartilage
3. Involvement of more than a third of opposite cord

It should be stressed that failure rates are higher in patients with:

1. Involvement of anterior commissure as these tumors have a propensity to involve the subglottic area
2. Impaired vocal cord mobility due to involvement of paraglottic space i.e. Thyroarytenoid muscle involvement makes things pretty difficult

Procedure:

This surgery is performed under general anesthesia.

Tracheostomy:

As a preliminary step a tracheostomy should be performed under local anesthesia via a transverse skin crease incision. Through the

tracheostome a Laryngectomy endotracheal tube (Laryngoflex) is introduced. It is shaped like a Shepard's crook.



Figure showing laryngoflex endotracheal tube

Advantages of laryngoflex endotracheal tube:

1. Its shape helps in anchoring the tube to the anterior chest wall without fear of tube migration.
2. After insertion this tube is away from the field of surgery
3. The presence of curvature prevents development of excessive pressure over the stoma while the patient is being ventilated

Incision:

Gluck Sorenson incision is preferred. This incision ensures adequate exposure of the surgical field. It is a curved incision extending along the anterior border of sternomastoid muscle from the mastoid tip on both sides. In the midline incision of both sides are joined at the level of tracheal stoma. Before incising the skin it is always better to mark the incision over the skin using skin pencil.



Figure showing Gluck Sorenson incision marked on the neck of the patient

Elevation of flap:

Neck flap is raised in the subplatysmal plane. This plane is ideal because blood supply to the flap is derived from the platysma muscle.

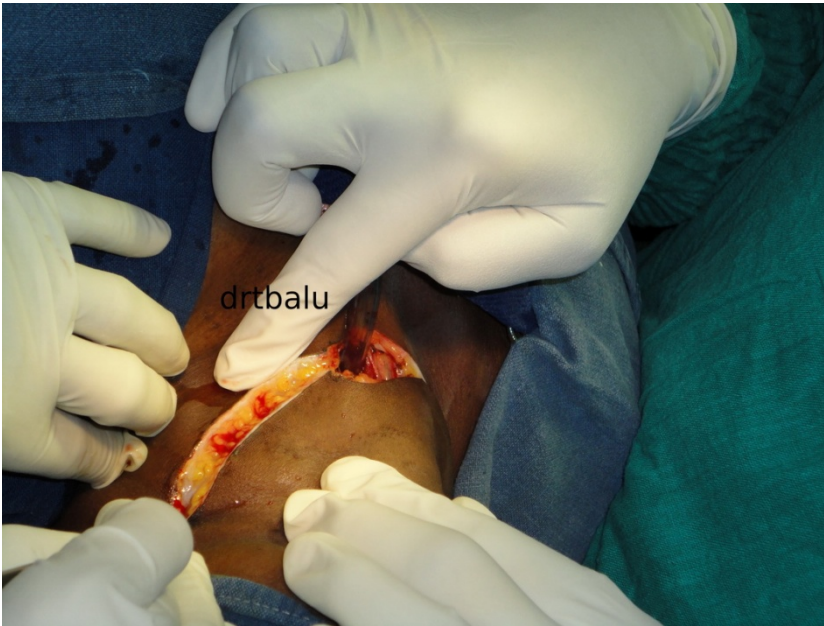


Figure showing cervical flap being raised

After elevating the cervical flap the strap muscles of the neck are identified. The Sternohyoid muscle on the side of surgery should be identified, separated and held aside using a tape. This muscle is vital during reconstruction of the defect which arises after vertical partial Laryngectomy.

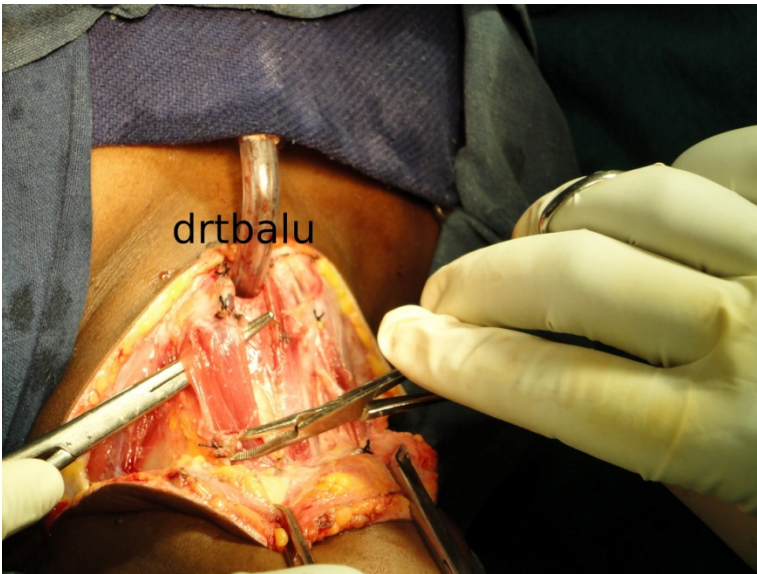


Figure showing Sternohyoid muscle being separated

The sternothyroid and thyrohyoid muscles are divided at the level of the thyroid cartilage and held apart using tied silk threads.

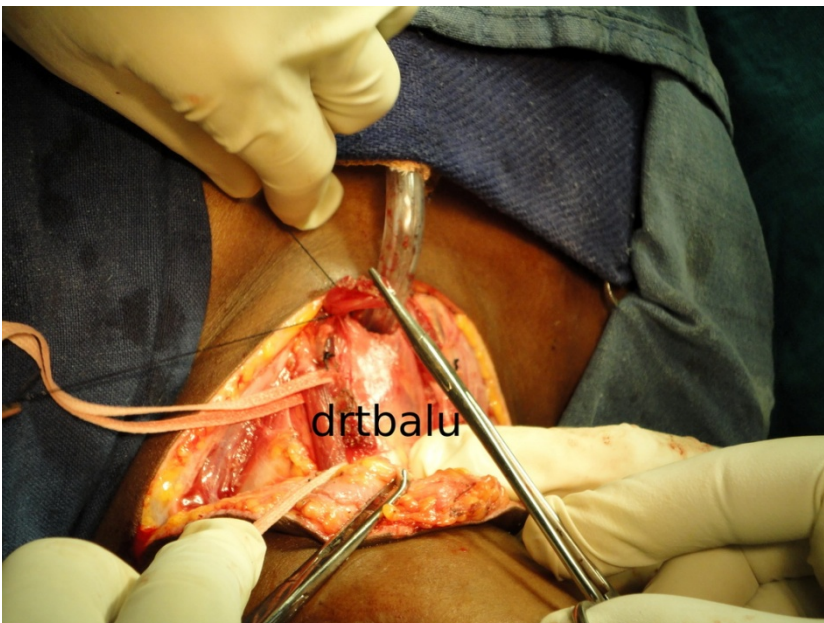


Image shows Sternohyoid muscle being held apart by tapes. The sternothyroid muscle is seen being divided and marked with a silk knot.

The perichondrium over the lamina of the thyroid cartilage on the side of the surgery is elevated and dissected out. Its lateral attachment to the lateral / posterior border of thyroid cartilage

should be preserved. This perichondrium can be reliably used to reconstruct the surgical defect after surgery.

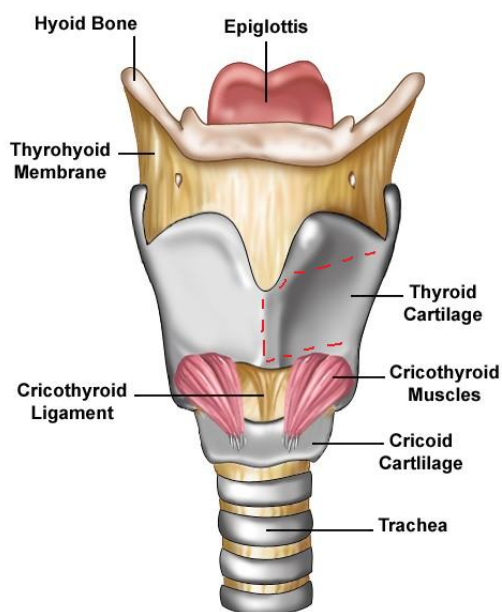


Figure showing thyroid perichondrial incision marks

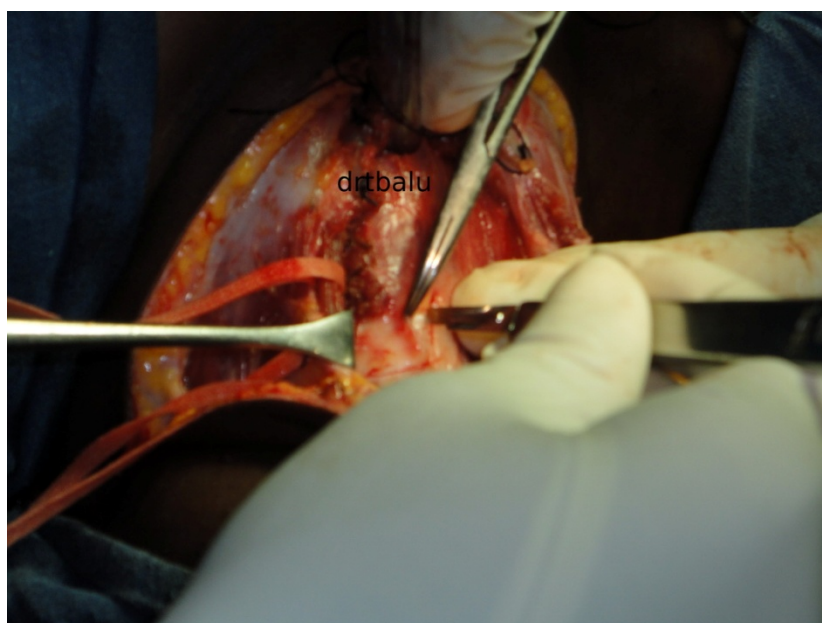


Figure showing perichondrium being incised

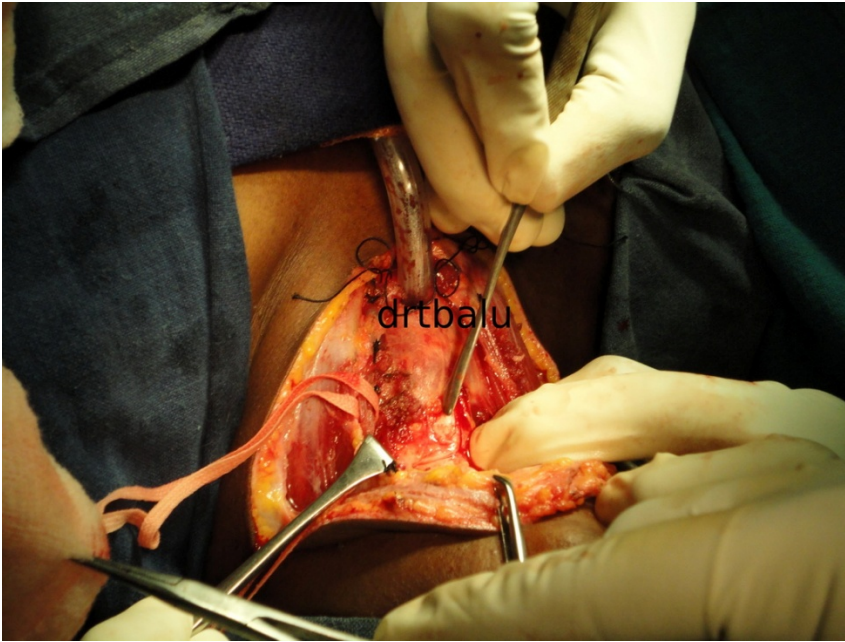
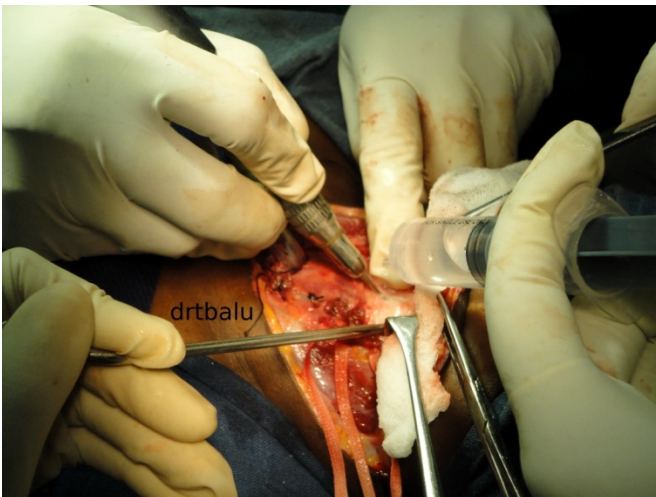


Figure showing perichondrium being stripped away

Before incising the perichondrium it is always better to infiltrate saline under the perichondrium in order to facilitate easy elevation of the same.



As shown above a fissure burr is used to make a vertical cut in the middle of thyroid cartilage beginning at the thyroid notch. Care must be taken not to enter the larynx at this juncture. The inner perichondrium of the thyroid cartilage is left intact till the interior of larynx is completely examined from below.

Examination of interior of larynx from below:

This is possible by incising the cricothyroid ligament and visualizing the vocal folds from below. If there is no subglottic extension the surgery can proceed without any modifications.

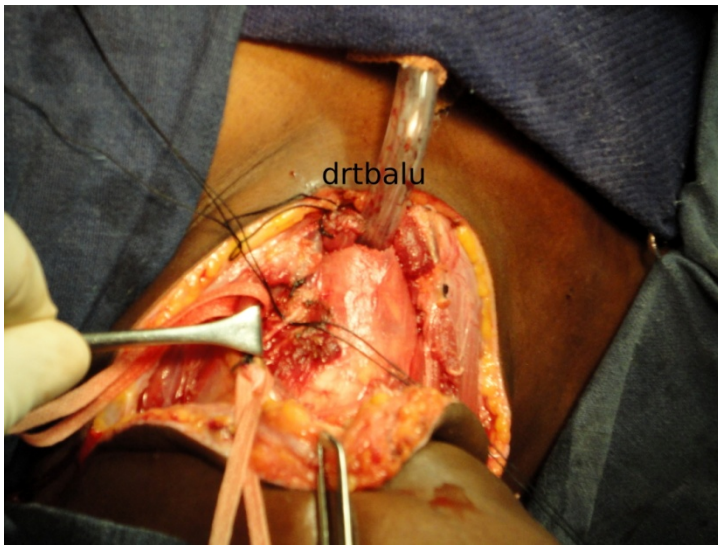


Figure showing ligation of superior laryngeal pedicle

Ligation of superior laryngeal pedicle:

This is a must before the interior of larynx is entered. If done before entering larynx the field inside the larynx would be dry without any troublesome bleeding. The superior laryngeal artery and vein should be identified close to the superior pole of larynx on its lateral aspect and are ligated.

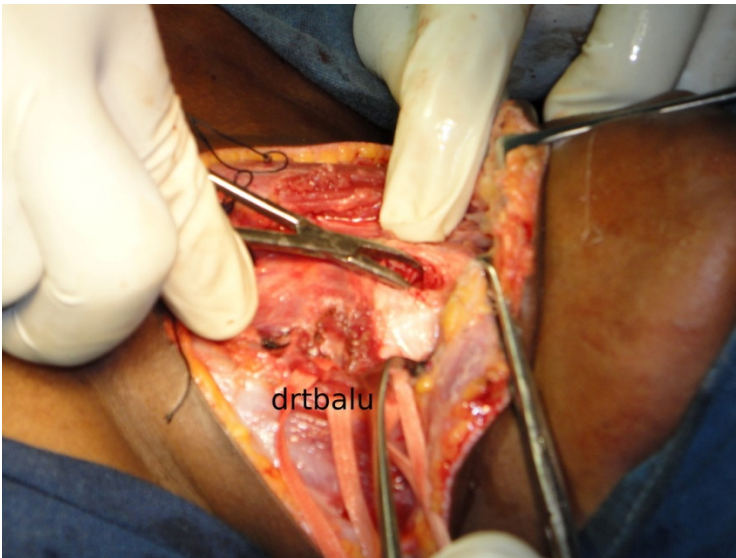


Figure showing larynx being entered in the midline

Two more cuts are made in the horizontal direction over the thyroid cartilage. These cuts are made using fissure burr. The superior transverse cut is made just below the superior border of the thyroid cartilage and the inferior transverse cut is made in the lower border of the thyroid cartilage just above the level of cricoid cartilage.

Entry in to larynx:

The larynx is entered in the midline after incising the inner perichondrium of the thyroid cartilage in the midline. The thyroid cartilage opens like a book revealing the contents of the larynx.

The growth in the vocal cords can be clearly viewed now.

The lamina of the thyroid cartilage is held using Allis forceps / Babcocks forceps. The whole of one side of the larynx is removed by cutting the attachments along with the true and false vocal folds. The cut should not be made across the arytenoid cartilage as it would cause troublesome swelling in patients who have undergone preoperative irradiation. The arytenoid cartilage and its muscular process are usually retained as it is very rare for malignant lesion to involve cartilage.

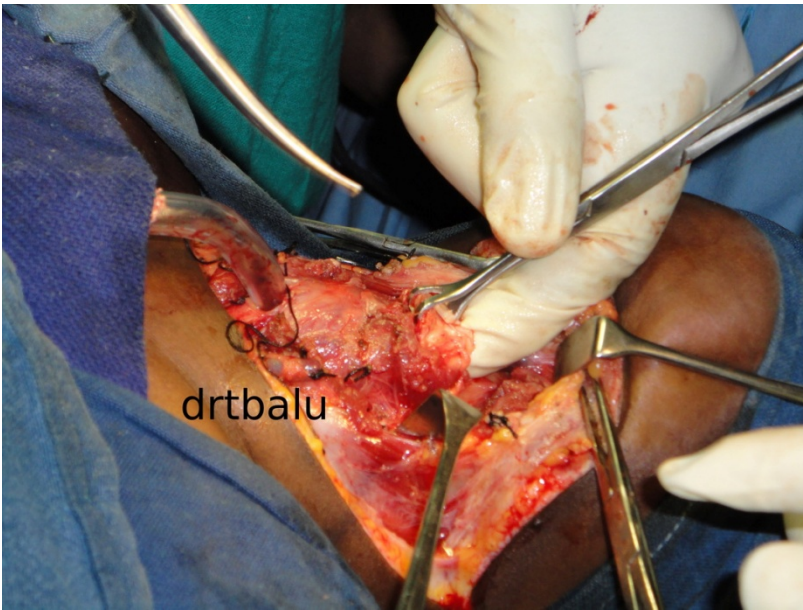


Figure showing the thyroid cartilage being held with a Babcocks forceps

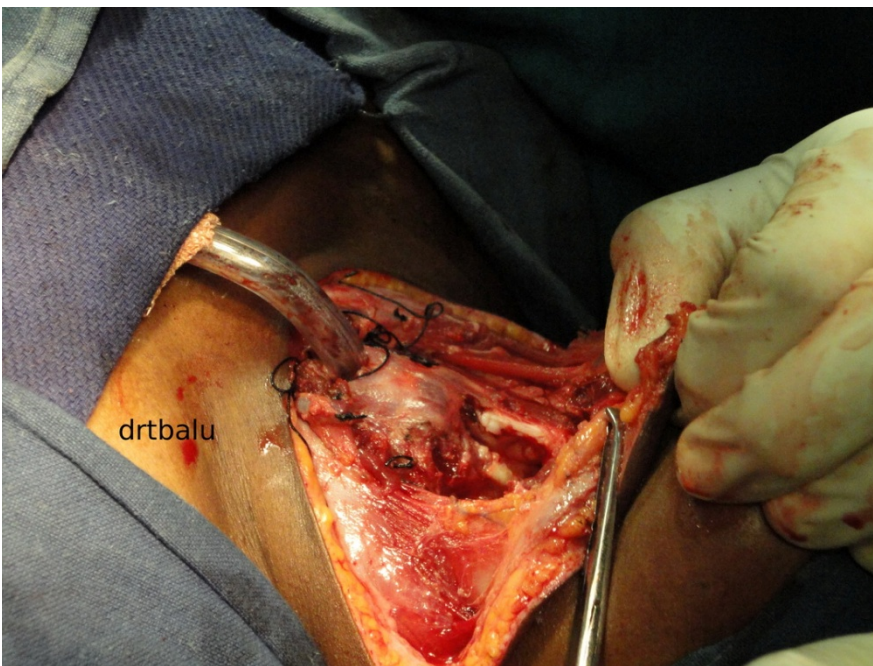


Image showing the inside of larynx with normal opposite side after removal of one half of the larynx

Repair:

This is the most critical element of the whole surgical procedure. If not done properly it could lead to breathing and feeding difficulties. The pyriform fossa mucosa which is redundant on the

side of laryngeal resection is dissected out and used to line the interior of larynx on the involved side.

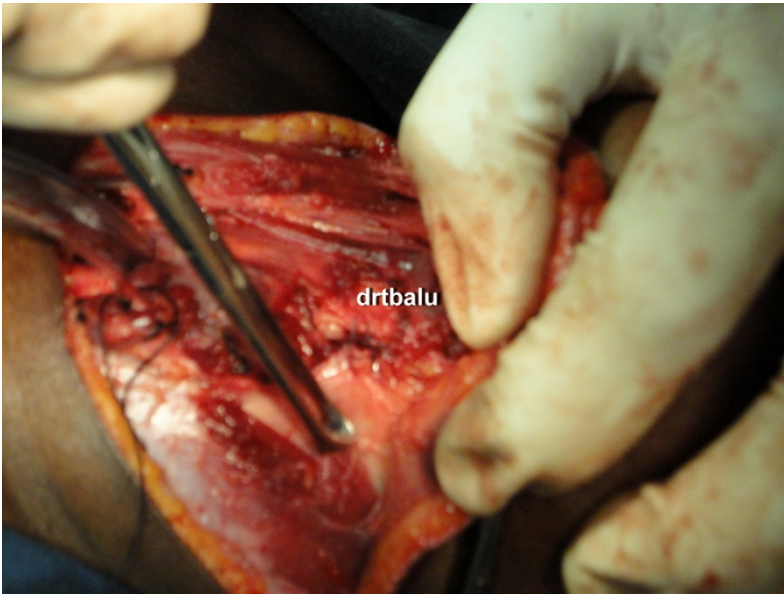


Image showing the redundant pyriform fossa mucosa being used to line the larynx on the involved side

The strap muscles sternothyroid and thyrohyoid are used to reconstruct the vocal folds. This is made possible by suturing their everted edges together using a non-absorbable suture like prolene.

The other strap muscle Sternohyoid which was retracted and held away using tapes can be mobilized to line the lateral surface of the reconstructed larynx. The redundant cervical fascia can be sewn over this muscle in order to strengthen it.

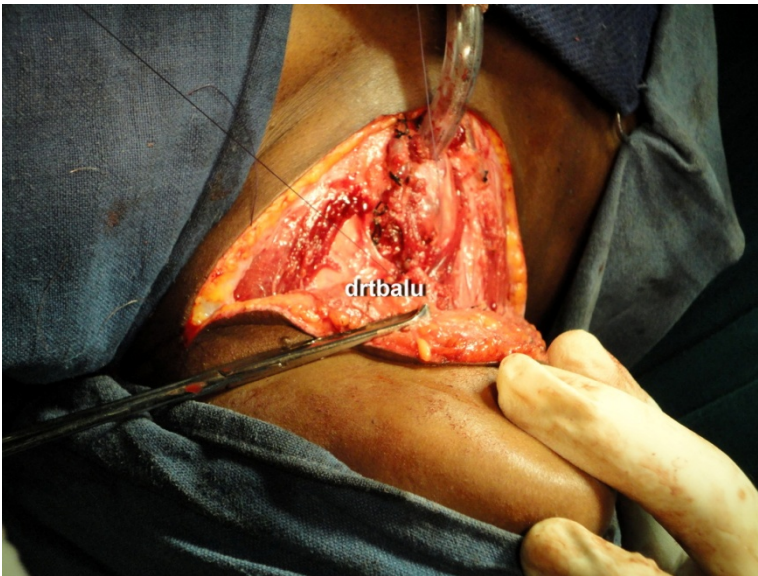


Image showing the cervical fascia being sutured over the Sternohyoid muscle

The wound is closed in layers after keeping a Romovac drain in place.



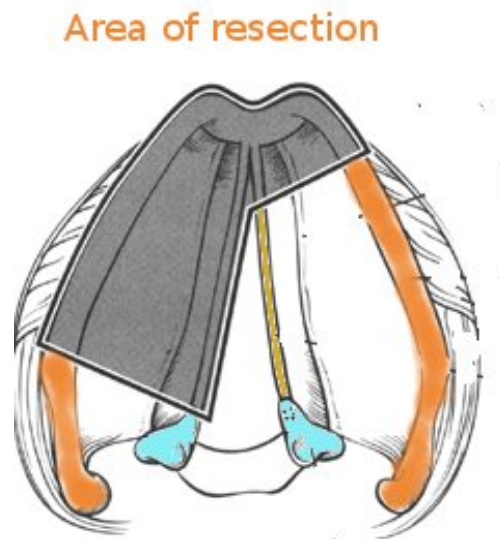
Skin closure being performed after placing the drain in the cavity

Complications:

1. Emphysema – Is common due to air leak in the immediate post-operative period. It can be managed by compression dressing.
2. Oedema of remaining arytenoid
3. Polypoidal changes in the laryngeal mucosa – Needs to be excised if present
4. Laryngeal stenosis
5. Laryngocele

Frontolateral vertical partial laryngectomy:

In this surgical procedure a portion of the opposite cord is also removed sparing the opposite arytenoid.



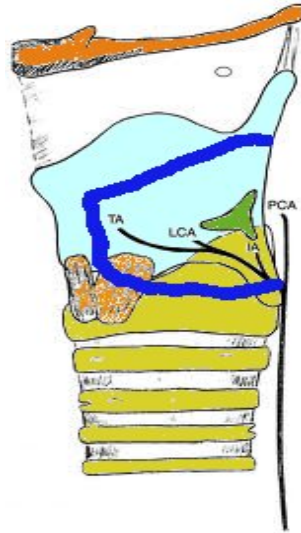


Image showing the extent of resection in the frontolateral partial laryngectomy

Indications:

1. Vocal cord tumors involving the full length of the cord up to the anterior commissure
2. The tumor should not involve more than anterior 1/3 of the opposite cord
3. The false vocal cords and the lateral ventricular wall should be free of the tumor

This procedure permits removal of one vocal cord completely along with anterior commissure, the anterior part of opposite cord and the corresponding portions of upper subglottis.

Procedure:

Since this surgery requires a clear view of intralaryngeal soft

tissues intubation via a preliminary tracheostomy is always better. An apron flap incision is always better as it can be easily extended to perform neck node dissection also.

Procedure is almost the same as described for vertical partial laryngectomy. The difference lies in the cartilage incision. Two vertical incisions are made on the thyroid cartilage after resection of the perichondrium on either side of midline. Superior and inferior tunnels are created under the thyroid cartilage.

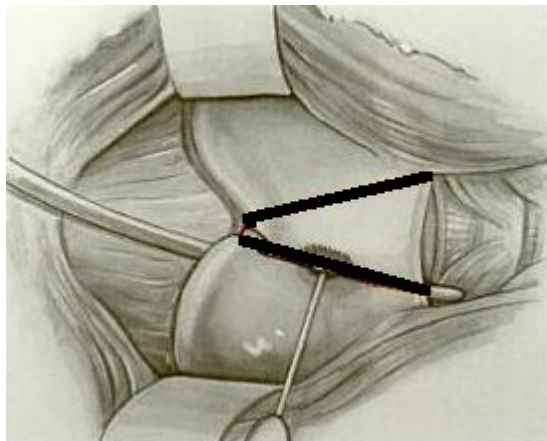


Figure showing cartilage incision

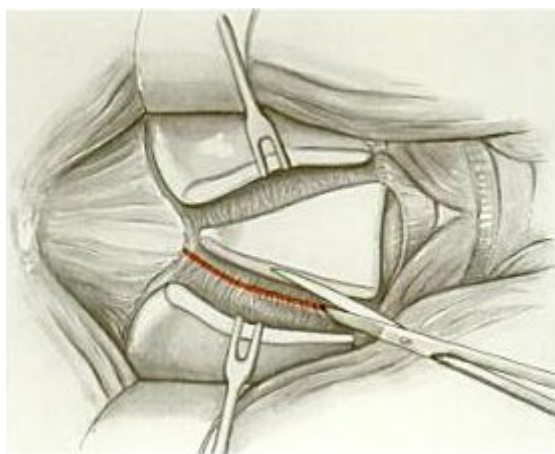


Figure showing wedge of thryoid cartilage being removed along with soft tissue

The ala of the thyroid cartilage is carefully separated using retractors leaving the freed central portion attached to the soft tissues. Slight tension is transmitted to these soft tissues by gentle traction in a lateral direction of the ala of thyroid cartilage. The interior of the larynx is entered on the side opposite to that of the tumor through the cricothyroid ligament at the inferior border of thyroid cartilage. A scissors is introduced through the inferior cleavage created and the intralaryngeal soft tissues are cut and the mass along with lamina of the thyroid cartilage is removed in toto. While removing the mass in to it should be freed posteriorly. The exact placement of the posterior incision depends on the degree of tumor extension toward the arytenoid cartilage.

- If the tumor has not reached the vocal process then the incision should run anterior to the vocal process
- If the tumor has reached up to the tip of the vocal process then the resection should include the vocal process also freeing it from the body of the arytenoid cartilage
- If vocal process is extensively involved then the resection should pass through to include the body of the arytenoid as well

Tips:

1. While incising the cricothyroid ligament to enter the larynx the incision should not be placed in the midline. It should be placed lateral to the midline on the side of the healthy cord. This provides greater freedom of movement over the anterior commissure area
2. Meticulous anterior fixation of the true and false cords is a must and should be done without causing excessive tissue tension
3. Subperichondrial elevation of laryngeal soft tissues should be done with extreme care using thin fine instruments

4. When a self retaining retractor is used to hold the thyroid laminae apart it should be used gently as it could cause fracture of thyroid cartilage
5. While making the posterior cut to remove the mass the articulation between the arytenoid cartilage and the cricoid cartilage should not be disturbed as it is essential for normal speech production
6. Exposed portions of arytenoid cartilage should be covered with mucosa because a bare cartilage carries with it the risk of perichondritis and adhesion formation
7. The region of prelaryngeal lymph nodes should be carefully examined to rule out metastasis in patients with tumor involving the anterior commissure
8. If resection of an entire arytenoid needs to be done then a total laryngectomy should be resorted to as a partial one with removal of arytenoid cartilage is really meaningless

Repair:

The inner lining is provided by the redundant pyriform mucosa on the side of the lesion. The strap muscles of the neck can be used to add bulk to the laryngeal reconstruction.

Anterior frontal partial laryngectomy & its modifications:

The original principle of this surgery is that it is more frontal than lateral. In all other aspects it is technically similar to other types of vertical partial laryngectomies. This procedure is appropriate for small tumors confined to the anterior commissure with very minimal supraglottic / subglottic extension. Studies have revealed that a majority of centrally located malignant lesions spread superiorly along the petiole of the epiglottis. In order to provided

reliable clearance during surgery it is prudent to include the angle of the thyroid cartilage and either part or whole of the epiglottis to ensure reliable tumor clearance (extended frontal partial laryngectomy).

Indications for classic anterior partial laryngectomy:

1. Tumors confined to the circumscribed area of anterior commissure
2. Showing minimal subglottic / supraglottic extension
3. Tumors that have not reached the inferior border of thyroid cartilage or the stem of the epiglottis superiorly
4. Tumors involving no more than anterior 1/4 of the vocal cords
5. These tumors should not have caused bilateral vocal cord fixation

Indications for extended anterior partial laryngectomy include:

1. All the conditions listed above plus
2. Midline tumor extension above the anterior commissure reaching the stem and perhaps part / whole of the epiglottis and the pre-epiglottic space

Principle of anterior partial laryngectomy:

The classic anterior partial laryngectomy involves removal of anterior portions of both true vocal cords along with the anterior commissure and adjacent anterior portion of thyroid alae.

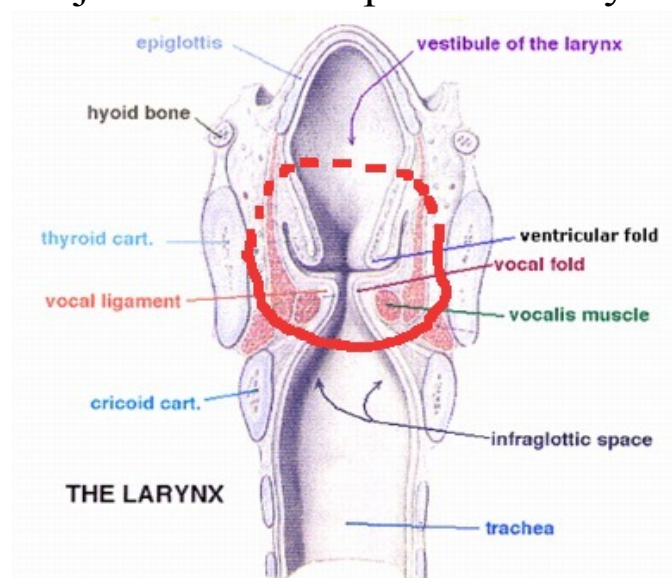


Figure showing the lines of resection of anterior partial laryngectomy

The surgical procedure of extended anterior partial laryngectomy adds to the classic operation the following:

1. Removal of epiglottis
2. Removal of hyoid bone
3. Removal of pre-epiglottic space

Surgical differences between vertical partial and anterior partial laryngectomy:

In anterior partial laryngectomy the subperichondrial soft tissue dissection extends slightly farther from the midline on either side. The cartilage incision is virtually shaped like an equilateral triangle with its apex at the level of thyroid notch.

The incision over cricothyroid ligament is placed further laterally in order to facilitate complete visualisation and removal of the mass.

Since anterior commissure is removed in this procedure a meticulous reconstruction of this area is a must otherwise it would lead to post operative laryngeal stenosis. In order to prevent this

complication from occurring retention sutures should be placed through the newly fashioned anterior commissure and tied outside the larynx in order to secure the opposing epithelial surfaces of the laryngeal interior.

Tips:

1. Laryngeal advancement sutures should be placed on both sides to provide secure fixation of both true and false cords
2. In extended anterior partial laryngectomy it is important to identify and preserve the superior laryngeal nerve on either side. Bilateral disruption of this nerve is known to cause severe dysphagia which could be troublesome

Horizontal partial laryngectomy: (Supraglottic partial laryngectomy)

Alonzo introduced this technique in 1947. He performed this surgery as a two staged procedure. Som in 1959 converted this surgery into a single stage procedure and popularized it.

This procedure is name thus because the initial cut to enter the larynx is through a transverse / horizontal cut. Since the incision is distant from the cancer it allows safe entry into the larynx for tumor inspection without the risk of tumor breach.

This procedure is intended to treat pure supraglottic tumors. The rationale of this procedure is based on the following oncologic principles:

1. The supraglottic region's embryological origin is different from that of glottic and subglottic origin. It arises from the embryonic buccopharyngeal analge while the glottis and subglottis arise from the embryonic tracheobronchial anlage.
2. Due to this embryological different origin early tumors of

supraglottis stops short of the level of vocal folds. It extends only up to the level of false cords only.

3. Supraglottic tumors have a tendency to spread superiorly and anteriorly and are hence characterised as ascending tumors
4. Supraglottic tumors have a propensity to penetrate the epiglottis and involving the pre-epiglottic space

Indications:

1. The tumor should be confined to the supraglottic region of endolarynx and should not extend inferiorly past the false cords
2. Both arytenoids should be uninvolved and freely mobile
3. The tumor should not have reached the oropharynx (should not involve the lingual surface of epiglottis)
4. Aryepiglottic fold and post cricoid area should be free

Principle of surgery:

The entire upper portion of the larynx is removed up to the level of true vocal cords thereby preserving all the vital laryngeal functions. Since the whole of the supraglottic area is considered to be a single oncological unit it is mandatory to remove the entire supraglottic area even in patients with unilateral involvement. If the lesion is extensive then hyoid bone and posterior third of the tongue can also be sacrificed.

Surgical technique:

This surgery is performed under general anesthesia which is administered via tracheostomy. The classic Gluck Sorenson laryngectomy incision is preferred as it provides excellent exposure of the neck.

The larynx is skeletonized more on the side of the greater involvement.

The sternohyoid muscle is divided just below the hyoid bone and is reflected below. The thyrohyoid muscle is removed.

The larynx is rotated towards the opposite side with the help of a single pronged hook. The pharyngeal constrictors are released from the posterior border of the thyroid cartilage with the help of scissors. The hyoid bone is not divided / removed but is conserved.

On the same side of the lesion an incision is made through the external perichondrium of the thyroid cartilage in a horizontal direction.

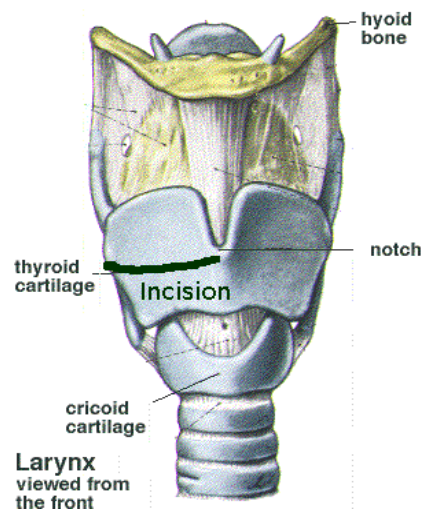


Figure showing outer perichondrial incision

A flap of outer perichondrium is dissected carefully from the thyroid cartilage and reflected downwards. This procedure exposes roughly upper 2/3 of the anterior surface of thyroid cartilage.



Figure showing the upper 2/3 of thyroid cartilage being exposed after reflection of external perichondrial flap.

This perichondrial flap could be used in the reconstruction process after completion of surgery.

The superior cornu of the thyroid cartilage is exposed and divided. Ipsilateral superior laryngeal artery, vein and nerve are ligated.

The laryngeal soft tissues are bluntly separated from the thyroid cartilage in the subperichondrial plane up to the level of vocal folds on both sides. The upper portion of the thyroid cartilage is resected on the side of greater involvement using fissure burr.

The pharynx is entered at the level of the resected superior cornu of the thyroid cartilage. The inside of the larynx can now be clearly seen and the extent of the growth can be assessed accurately.

The free border of the epiglottis is grasped with Babcock's forceps and delivered via the pharyngotomy incision. The mucosa on the lingual surface of epiglottis is carefully dissected off the cartilage. If epiglottis is involved by the tumor then this step should be skipped.

The line of resection for dividing supraglottis from the rest of the larynx starts from the tense aryepiglottic fold on the side of greater involvement anterior to the prominence caused by arytenoid cartilage using scissors. This cut extends through the supraglottic soft tissues towards the ipsilateral cord passing anterior to the arytenoid towards the ventricle. This incision continues towards the lateral ventricular wall above the level of vocal cords. This incision is then extended to include the opposite supraglottic area also. The specimen is completely freed by cutting through the floor of the vallecula on the lingual side.

The cut surfaces of soft tissues are covered by mucosa stripped from the pyriform fossa.

The first layer of closure is performed to cover the laryngo pharyngeal defect. This is done by suturing the perichondrial flap from the thyroid cartilage to the mucosa resected from the lingual surface of epiglottis.

The second layer of closure is established by reapproximation of strap muscles.

Contraindications:

1. Involvement of cricoid / thyroid cartilage
2. Impaired mobility / fixity of vocal cords
3. Impaired tongue mobility
4. Mucosal invasion of both arytenoids
5. Extension into the glottic area

Supracricoid partial horizontal laryngectomy:

This procedure was first described by two Austrian surgeons Majer & Reider in 1959. They performed cricothyroidopexy in order to avoid permanent tracheostomy. Since the results were highly variable it fell in to disrepute. In 1970 French surgeons Labayle and Piquet modified this procedure and rechristened it as subtotal laryngectomy. They standardized the reconstruction procedure as cricothyroidopexy (CHP) / cricothyroidoepiglottopexy (CHAP).

This surgical procedure bridges the gap between partial open procedures and total laryngectomy.

Traditionally glottis was considered to be the functional unit of larynx which maintains the physiological functions like production of speech and sphincteric function while swallowing. Since 1980 the concept of functional unit of larynx has undergone tremendous changes. It is these changes that helped us to refine the technique of supraglottic partial laryngectomy.

Studies have demonstrated that the real functional unit of larynx

happens to be the cricoarytenoid unit. The driving force of phonatory function depends on a mobile and sensate cricoarytenoid unit. The vocal cords and the thyroarytenoid muscle provides refinement and range to the sound generated.

Components of cricoarytenoid unit:

1. Cartilages – Cricoid (signet ring), arytenoids, corniculate and cuneiform cartilages
2. Muscles – Posterior cricoarytenoid, lateral cricoarytenoid and interarytenoids
3. Nerves – Recurrent laryngeal nerve and superior laryngeal nerve

According to this cricoarytenoid functional unit concept speech & swallowing is possible by preserving one / both cricoarytenoid unit with special attention to the attachment of posterior and lateral cricoarytenoid muscles. This also allows the neoglottis to abduct / adduct postoperatively. To ensure a good surgical outcome all the components of cricoarytenoid unit should be preserved.

Vocal cord fixation occurs due to the involvement of paraglottic space by the tumor / invasion of thyroarytenoid muscle. This surgical procedure facilitates safe excision of paraglottic space / thyroarytenoid muscle. It also allows for complete excision of lateral and posterior cricoarytenoid muscle if the arytenoid on the tumor bearing side needs to be disarticulated.

Procedure:

In this surgical procedure true vocal cords, false cords, paraglottic space along with entire thyroid cartilage can be excised. If need be the pre-epiglottic space and the epiglottis can also be included in the resection. If during reconstruction a CHEP is planned lower 1/3 of the epiglottis is retained. If need be the arytenoid on the

tumor bearing side can also be excised in order to secure a good tumor free margin. However it is essential to conserve one intact and sensate cricoarytenoid unit and the entire cricoid cartilage.

Post operative laryngeal reconstruction:

Is usually accomplished by using elements of the intact cricoarytenoid unit and a cricohyoid impaction. For adequate wound closure a pexy is done between the cricoid and hyoid bone , or by using the preserved portion of the epiglottis. Non absorbable sutures should be used for cricohyoid impaction.

Indications:

1. In T1, T2, T3, Glottic / Transglottic / supraglottic tumors
2. Selected T4 lesions with limited invasion of thyroid cartilage without involving the outer perichondrium
3. Salvage surgery after failure of radiotherapy

Contraindications:

1. Involvement of interarytenoid area
2. Fixed arytenoids
3. Involvement of mucosa over arytenoids
4. Subglottic extension
5. Extralaryngeal spread of the tumor
6. Invasion of hyoid bone

Surgical procedure:

This procedure is performed under general anesthesia. Intubation via a preliminary tracheostomy will solve a lot of perioperative problems.

The procedure begins with the standard apron incision and

elevation of subplatysmal flaps superiorly up to 1cm above the level of hyoid bone and inferiorly up to the level of clavicles. The sternohyoid and thyrohyoid muscles are transected along the superior border of thyroid cartilage. The medial laryngeal vessels are ligated at this stage. The sternothyroid muscles are transected at the level of inferior border of thyroid cartilage. The inferior constrictor muscle and the external thyroid cartilage perichondrium are transected along its posterior border. The pharyngeal constrictors should be excised close to the posterior border of thyroid cartilage in order to protect the internal laryngeal nerve branches.

The pyriform fossae are released. Disarticulation of cricoarytenoid joint is performed on the involved side staying close to the joint in order to preserve the recurrent laryngeal nerve. The isthmus of the thyroid gland is transected right in the middle. Blunt dissection is performed along the anterior tracheal wall in order to free the trachea. This mobilizes the trachea thereby facilitating tensionless reconstruction.

The periosteum of the hyoid bone is incised and a freer's dissector is used to dissect out the pre-epiglottic space from the posterior surface of hyoid bone.

The larynx is entered through the vallecula superiorly and through the cricothyroid membrane inferiorly. The larynx is grasped with Allis forceps and endolaryngeal cuts are made.

The endolaryngeal cuts are begun from the uninvolved side. A vertical incision is made anterior to the arytenoid from the aryepiglottic fold to the cricoid using scissors. The entire paraglottic space lies anterior to this cut while the pyriform fossa lies posterior to it. The whole of the paraglottic space is included in the specimen while the pyriform fossa on the uninvolved side is spared. This incision is connected to that of the cricothyroid membrane incision above the superior border of cricoid cartilage. The thyroid cartilage is grasped and fractured in the midline to open

it like a book. Exision of the tumor bearing side is thus completed under direct vision. The arytenoid/arytenoids remaining after the surgery should be pulled forwards to the posterolateral aspect of cricoid cartilage with the help of 2-0 vicryl. This avoids posterior sliding of the arytenoids.

Cricohyoidpexy is performed. The hyoid bone and the cricoid cartilage are secured with the help of three submucosal sutures using 0 prolene. Midline one is placed first taking care to grab a bit of tissue on the posterior third of tongue. Strap muscles are used as a second layer support.